

Claims

- [c1] A device comprising:
a substrate with a device region;
a cap for encapsulating the device, the cap creates a cavity over the device region; and
spacer particles on the substrate to support the cap, the spacer particles comprising a base and an upper portion, the base being at least equal to or wider than the upper portion.
- [c2] The device of claim 1 wherein the device region comprises one or more cells.
- [c3] The device of claim 2 wherein the cells comprise at least one organic layer formed between lower and upper electrodes.
- [c4] The device of claim 3 wherein the lower electrodes are anodes and the upper electrodes are cathodes.
- [c5] The device of claim 3 wherein the upper electrodes are anodes and the lower electrodes are cathodes.
- [c6] The device of claim 3 wherein the spacer particles comprise a half-spherical shape.
- [c7] The device of claim 3 wherein the spacer particles comprise a pyramidal, cubical, prism, regular or irregular shape.
- [c8] The device of claim 3 wherein the spacer particles comprise a non-conductive material.
- [c9] The device of claim 8 wherein the spacer particles comprise glass, silica, polymers, ceramic or photoresist.
- [c10] The device of claim 8 wherein the spacer particles comprise an average diameter to maintain the height of the cavity.
- [c11] The device of claim 10 wherein the spacer particles comprise a density to maintain separation between the cap and the device region.

- [c12] The device of claim 11 wherein the density is about $10\ 1000\ \text{No/mm}^2$.
- [c13] The device of claim 12 wherein an average distance between the spacer particles is about $100\ 500\ \mu\text{m}$.
- [c14] The device of claim 1 wherein the spacer particles comprise a half-spherical shape.
- [c15] The device of claim 1 wherein the spacer particles comprise a pyramidal, cubical, prism, regular or irregular shape.
- [c16] The device of claim 14 wherein the spacer particles comprise a non-conductive material.
- [c17] The device of claim 16 wherein the spacer particles comprise glass, silica, polymers, ceramic or photoresist.
- [c18] The device of claim 17 wherein the spacer particles comprise an average diameter to maintain the height of the cavity.
- [c19] The device of claim 18 wherein the spacer particles comprise a density to maintain separation between the cap and the device region.
- [c20] The device of claim 19 wherein the density is about $10\ 1000\ \text{No/mm}^2$.
- [c21] The device of claim 20 wherein an average distance between the spacer particles is about $100\ 500\ \mu\text{m}$.
- [c22] A method for forming a device, comprising:
 providing a substrate with a device region;
 applying a layer of adhesive on spacer particles, the spacer particles comprising a base and an upper portion, the base being at least equal to or wider than the upper portion;
 depositing the spacer particles on the substrate;
 curing the layer of adhesive on the spacer particles; and
 mounting a cap on the substrate to encapsulate the device, the cap forms a cavity over the device region, the cavity maintained by the spacer particles.

- [c23] The method of claim 22 wherein the device comprises an OLED device.
- [c24] The method of claim 23 wherein the spacer particles comprise a non-conductive material.
- [c25] The method of claim 24 wherein the step of depositing the spacer particles comprises dry spraying.
- [c26] The method of claim 25 wherein the spacer particles occupy active and non-active parts.
- [c27] The method of claim 25 wherein the spacer particles occupy non-active parts.
- [c28] The method of claim 25 wherein coverage of the spacer particles on the substrate is patterned by photolithography technology.
- [c29] The method of claim 25 wherein coverage of the spacer particles on the substrate is patterned by shadow mask technology.
- [c30] The method of claim 25 wherein coverage of the spacer particles on the substrate is patterned by dry resist technology.
- [c31] The method of claim 24 wherein the step of depositing the spacer particles comprises wet spraying.
- [c32] The method of claim 31 wherein the spacer particles occupy active and non-active parts.
- [c33] The method of claim 31 wherein the spacer particles occupy non-active parts.
- [c34] The method of claim 31 wherein coverage of the spacer particles on the substrate is patterned by photolithography technology.
- [c35] The method of claim 31 wherein coverage of the spacer particles on the substrate is patterned by shadow mask technology.
- [c36] The method of claim 24 wherein the step of depositing the spacer particles comprises spin coating, doctor blading, screen printing or transfer printing.
- [c37] The method of claim 24 wherein the adhesive comprises thermal curable

material.

- [c38] The method of claim 24 wherein the adhesive comprises ultraviolet curable material.
- [c39] The method of claim 24 wherein the adhesive comprises hot melt material.
- [c40] A method for forming a device, comprising:
 providing a substrate with a device region;
 forming a plurality of spacer particles on the substrate, the spacer particles comprising a base and an upper portion, the base being at least equal to or wider than the upper portion; and
 mounting a cap on the substrate to encapsulate the device, the cap forms a cavity over the device region, the cavity maintained by the spacer particles.
- [c41] The method of claim 40 wherein the step of forming a plurality of spacer particles on the substrate comprises:
 depositing particles on the substrate; and
 heating the particles to a high temperature to cause the particles to reflow into the spacer particles having the base at least equal to or wider than the upper portion.
- [c42] The method of claim 40 wherein the step of forming a plurality of spacer particles on the substrate comprises:
 depositing a photoresist on the substrate; and
 patterning the photoresist into the spacer particles having the base at least equal to or wider than the upper portion.